CLAIMS

What is claimed is:

1. An electronically scanned array, comprising:

a linear array of radiating elements;

an array of phase shifters coupled to the radiating elements;

an RF manifold including a plurality of phase shifter ports respectively coupled to a corresponding phase shifter RF port and an RF port; and

a beam steering controller for providing phase shift control signals to the phase shifters to control the phase shift setting of the array of the phase shifters;

and wherein said phase shifters each include a plurality micro-electro-mechanical ("MEM") switches responsive to said control signals to select one of a discrete number of phase shift settings for the respective phase shifter.

2. The array of Claim 1, wherein said phase shifters include switched line phase shifters including a reference signal path and at least one phase shift signal path, each path having an electrical length selected to provide a phase shift value at an operating wavelength, and wherein the plurality of MEM switches are configured to select either said reference path or one of said at least one phase shift path.

3. The array of Claim 1 wherein said phase shifters include reflection phase shifters, wherein the MEM switches are connected to select one of a plurality of reactance values determining a phase shift value.

4. The array of Claim 3, wherein said reflection phase shifters each comprise a coupler device having first

and second RF I/O ports, and in-phase and quadrature ports, and first and second reactance circuits respectively coupled to the in-phase and quadrature ports by first and second MEM switch circuits.

5. The array of Claim 1 wherein said MEM switches are single-pole-single-throw (SPST) switches including an armature for opening and closing the RF signal path through the switch, and a control signal path, and wherein the control signals are isolated from the RF signal path.

6. An RF phase shifter circuit, comprising:

first and second RF ports;

a switch circuit comprising a plurality of single-pole-single-throw (SPST) micro-electro-mechanical ("MEM") switches responsive to control signals, said switch circuit arranged to select one of a plurality of discrete phase shift values introduced by the phase shifter circuit to RF signals passed between the first and second RF ports, said circuits connected to provide a single-pole-multiple-throw (SPMT) or multiple-pole-multiple-throw (MPMT) switch function.

7. The circuit of Claim 6, wherein said phase shift circuit is a switched line phase shift circuit, and further includes a reference phase signal path and at least one phase shift path, said switch circuit arranged to select one of said reference or said at least one signal paths in response to phase shift control signals.

8. The circuit of Claim 6, wherein a single MEM switch selects said reference signal path.

9. The circuit of Claim 8, wherein said single MEM switch provides said reference signal path.

10. The circuit of Claim 6 wherein said phase shifter is a reflection phase shifter, wherein the MEM switch circuit is arranged to select from a plurality of termination reactance values determining a phase shift value.

11. The circuit of Claim 10, further comprising a coupler device having first and second RF I/O ports, and in-phase and quadrature ports, said MEM switch circuit includes first and second reactance switch circuits selectively coupling first and second termination reactance circuits respectively to the in-phase and quadrature ports, each said reactance circuit including a plurality of selectable reactance values.

12. The circuit of Claim 11, wherein said first and second reactance switch circuits are arranged to select more than one of said plurality of said selectable reactance values for simultaneous termination of said in-phase and quadrature ports by said more than one of said plurality of selectable reactance values.

Sub C1

13. The circuit of Claim 12, wherein said first and second MEM switch circuits provide MPMT switching functions.

14. The circuit of Claim 6, wherein said MEM switches are metal-metal contact RF MEMS series switches.

15. A multi-section RF phase shifter circuit, comprising:

a plurality of phase shift sections connected in series to provide a discrete set of selectable phase shifts to RF signals passed through the circuit, and wherein each phase shift section includes:

first and second RF ports;

a switch circuit comprising a plurality of micro-electro-mechanical ("MEM") switches responsive to control signals, said switch circuit arranged to select one of a plurality of discrete phase shift values introduced by the phase shifter circuit to RF signals passed between the first and second RF ports, said circuits connected to provide a single-pole-multiple-throw (SPMT) or multiple-pole-multiple-throw (MPMT) switch function.

16. The circuit of Claim 15, wherein at least one of said phase shift sections is a switched line phase shift circuit section, which includes a reference phase signal path and at least one phase shift path, said switch circuit section arranged to select one of said reference or said at least one signal paths in response to phase shift control signals.

17. The circuit of Claim 16, wherein a single MEM switch selects said reference signal path.

18. The circuit of Claim 16 wherein at least one of said phase shift sections is a reflection phase shift section, wherein the MEM switch circuit is arranged to select from a plurality of termination reactance values determining a phase shift value.

19. The circuit of Claim 18, wherein said reflection phase shift section comprises a coupler device having first and second RF I/O ports, and in-phase and quadrature ports, said MEM switch circuit includes first and second reactance switch circuits selectively coupling first and second termination reactance circuits respectively to the in-phase and quadrature ports, each said reactance circuit including a plurality of selectable reactance values.

20. The circuit of Claim 19, wherein said first and second reactance switch circuits are arranged to select more than one of said plurality of said selectable reactance values for simultaneous termination of said in-phase and quadrature ports by said more than one of said plurality of selectable reactance values.

21. The circuit of Claim 20, wherein said first and second MEM switch circuits provide MPMT switching functions.

22. An RF switch circuit configured to provide a single-pole-multiple-throw (SPMT) or multiple-pole-multiple-throw switch (MPMT) function to RF signals, comprising a plurality of single-pole-single-throw (SPST) micro-electro-mechanical ("MEM") RF switches each responsive to DC control signals to control the open/closed state of the switch, said SPST MEM switches each including a first RF port and a second RF port, and wherein at least first and second ones of said SPST switches have said first ports connected at a common junction.

23. The switch circuit of Claim 22, wherein said SPST MEM switches are metal-metal contact RF MEMS series switches.

24. The switch circuit of Claim 22, wherein said function is a SPMT switch function, the number of switch throws is N, and said at least first and second ones of said SPST switches with said first ports connected at a common junction includes N SPST switches with respective first ports at said common junction.